KORG MS-20
OWNERS MANUAL

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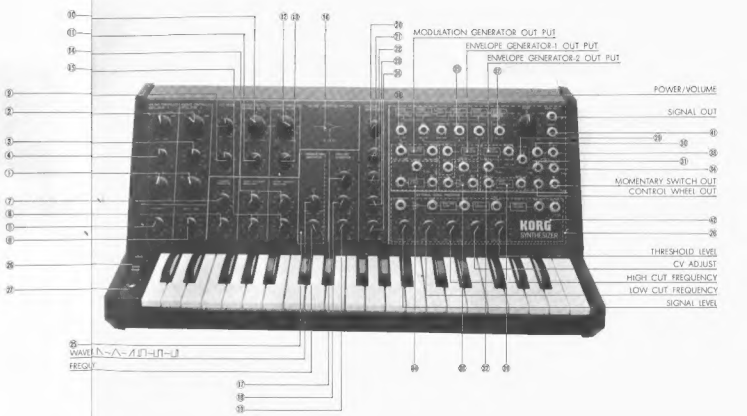
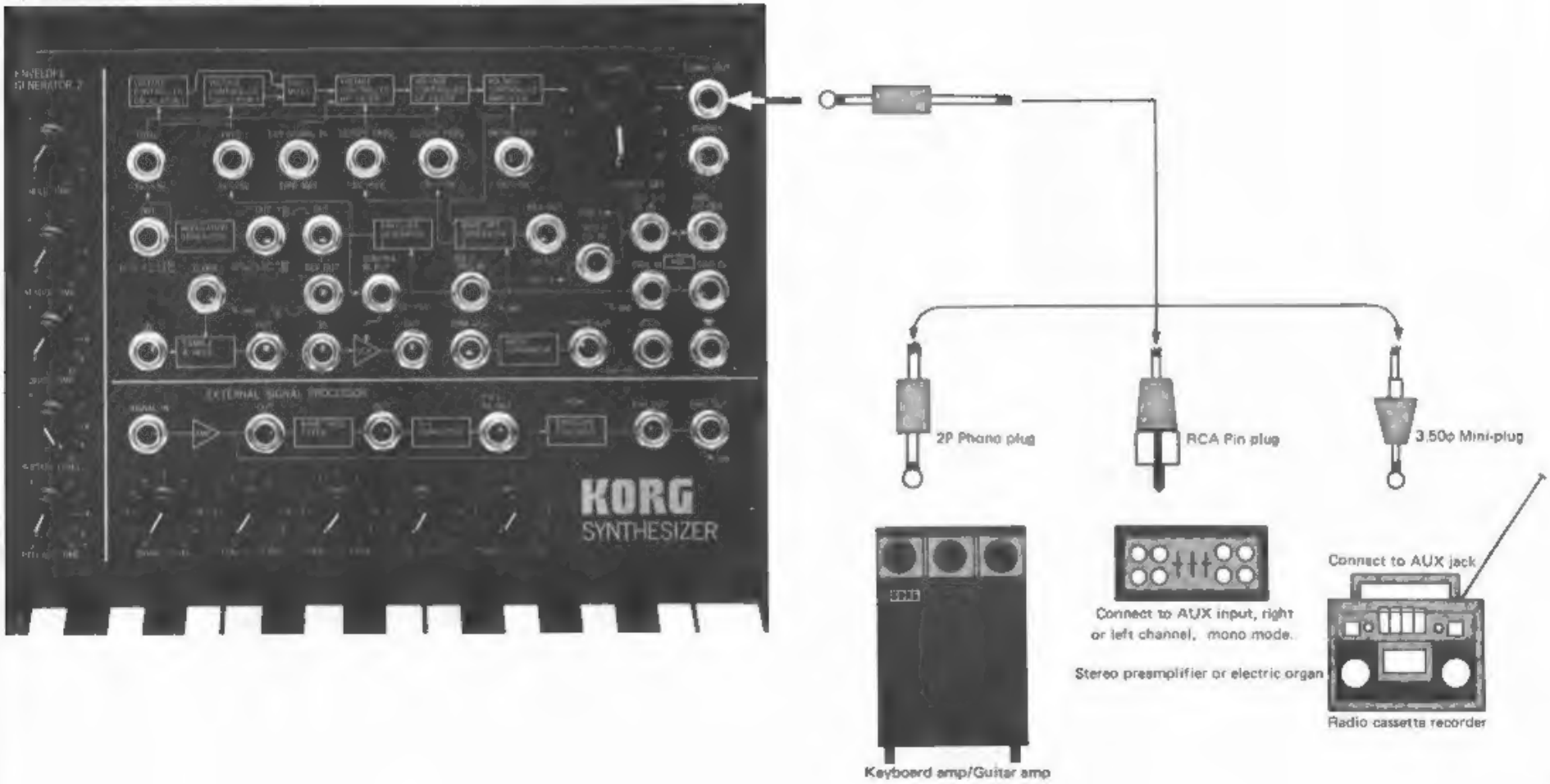


1) Introduction

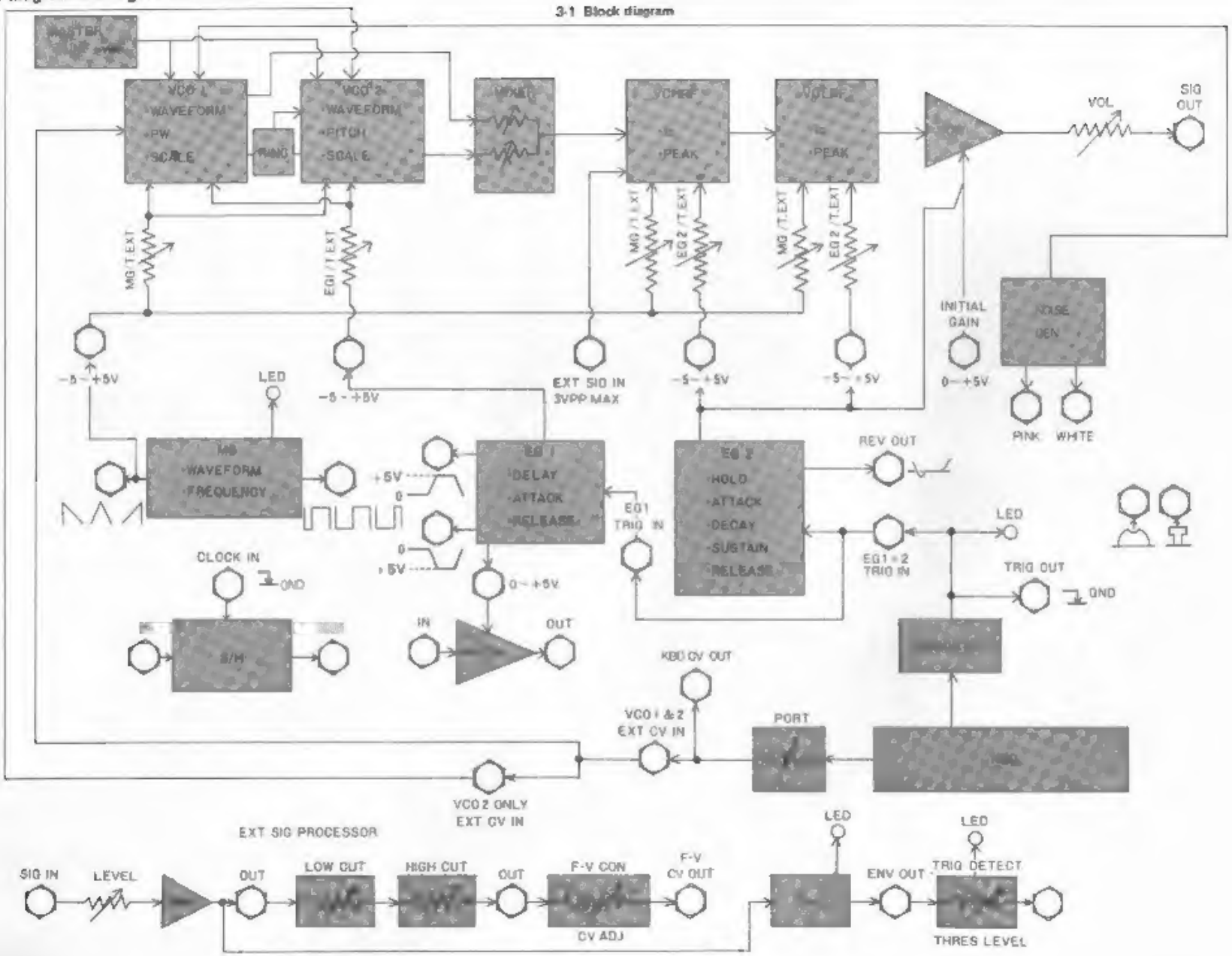
Congratulations on purchasing the Korg MS-20 Synthesizer. This instrument has been engineered and manufactured using the most advanced techniques known today, and features the same unparalleled technology utilized in Korg's revolutionary Polyphonic Synthesizers, the PS-3100 and PS-3300. With reasonable care, it will provide years of high quality and reliable use with unsurpassed stability, versatility and longevity.
Please read this manual carefully in order to get the most out of your MS-20.

2) Connection with an amplifier



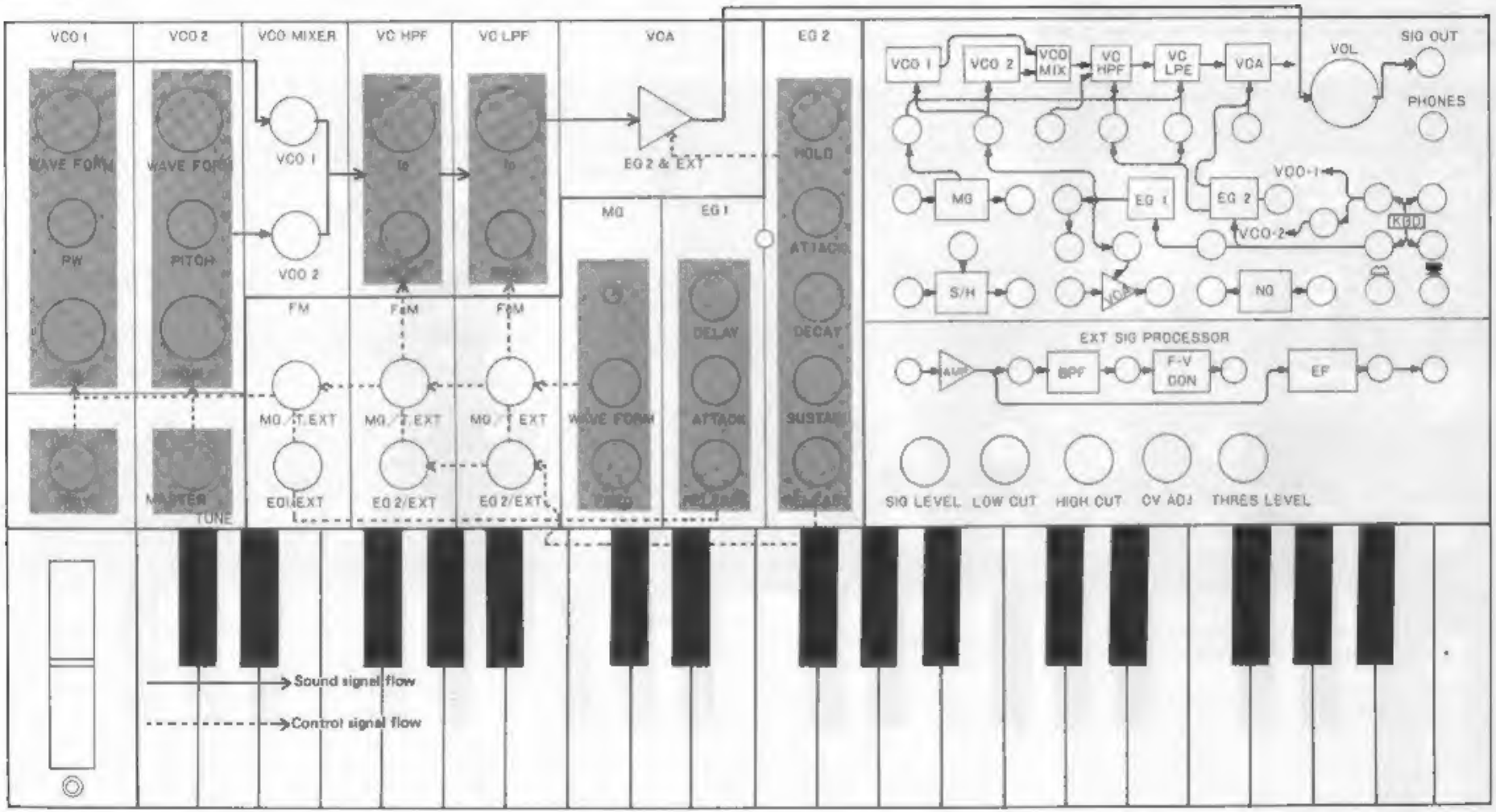
3) Block diagram and signal flow chart

3-1 Block diagram



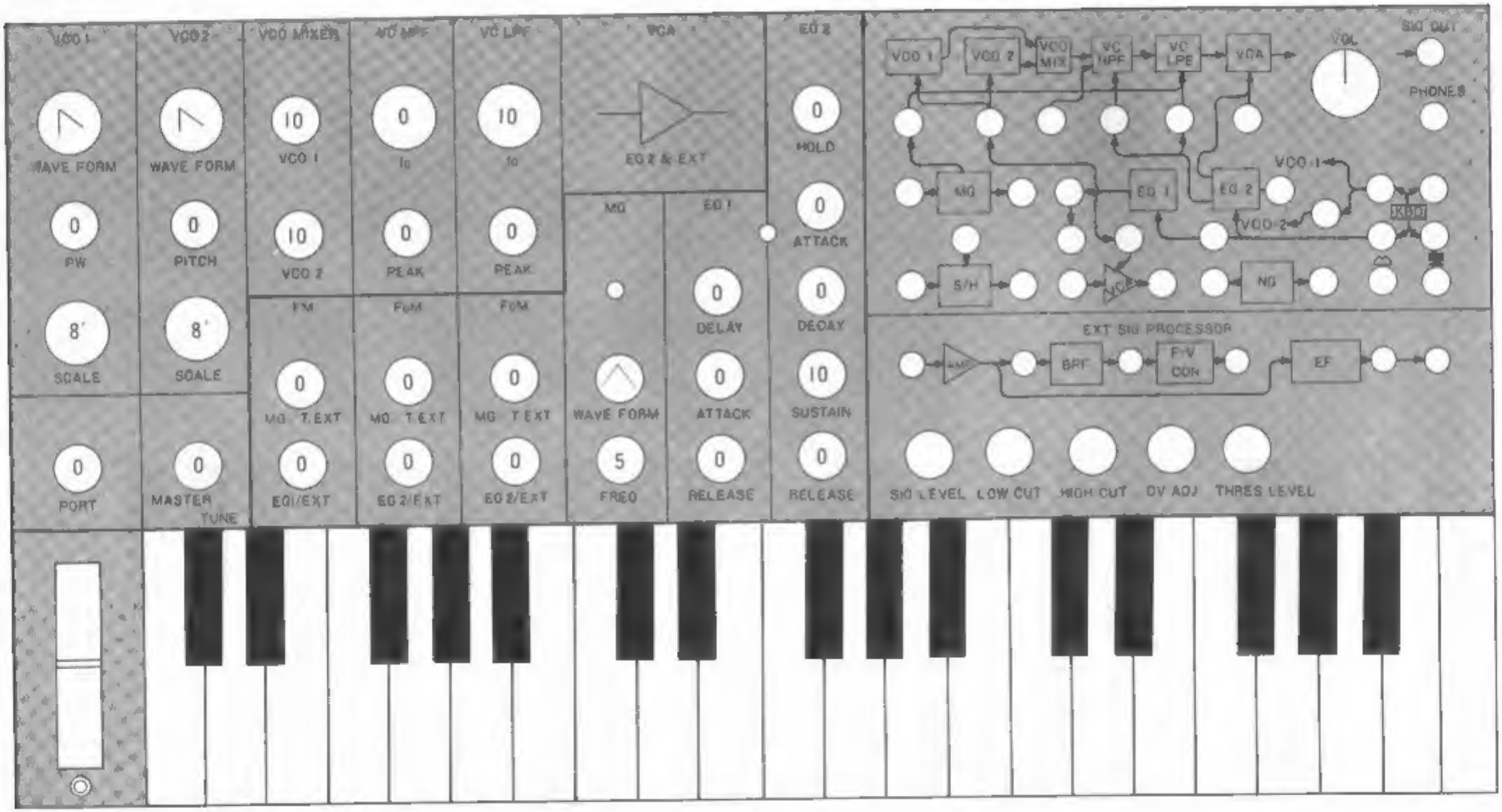
3-2 Signal Flowchart

This diagram shows the various signal paths in the MS-20 Synthesizer. Solid lines (→) represent sound (audio) signal flow; broken lines (⇢) represent control signal (control voltage) flow. Control signals are connected from various parts of the synthesizer to the VCO, VCF and VCA by means of internal patches. These internal patches may be supplemented by using the Patch Panel for added versatility.



4) Normal Setting

This diagram illustrates control positions for the Normal Setting. In this setting, all modulation functions are disconnected, producing a basic unmodulated tone. Since VCO-1 and VCO-2 sound together, adjust VCO-2's pitch to match VCO-1's by means of the Pitch control. This Normal Setting is the foundation on which you will build when creating sounds with the MS-20. You will find it useful to be able to return to this setting whenever you start a new patch. Therefore, it is recommended that you memorize these control positions for greater efficiency of operation.



5) Features and functions

Voltage Controlled Oscillator (VCO)

The VCO is the source of all sound for the MS-20 synthesizer. It is here that all pitch and basic tonal color elements are determined. The MS-20 is equipped with two wide-range VCOs.

① **Scale:**

This control is an Octave selector. With each halving of the number displayed, the pitch goes up one octave. For example the 4' (foot) scale indication is one octave higher than 8'; similarly, 16' is one octave lower than 8'. VCO-1 is variable from 32' to 4'; VCO-2 is variable from 16' to 2'.

② **Waveform:**

This selects the various waveforms that determine the basic tone color (timbre). VCO-1 has four waveforms: ⋀, ⊓, ⊓-⊓, ⌇ ; VCO-2 has three waveforms: ⋀, ⊓, ⊓-⊓ , plus a Ring Modulator setting. Each waveform has its own unique characteristic sound.

⋀

(Triangle Wave): A very basic waveform having few harmonics, and possessing a soft, round tone color. Excellent for flute, vibes and other such effects. The Triangle Wave may be changed into a Sine Wave (having no harmonics) by using the Low Pass Filter.

◺

(Sawtooth): A waveform rich in all harmonics, and one of the most useful to the synthesist. Used for string, brass, voice and other harmonically rich sounds. The Voltage Controlled Filter (VCF) is highly effective on Sawtooth Waveforms.

⊓-⊓

(Rectangle Wave): A variable waveform having different timbres depending on the width of the top (called Pulse Width). When the top and bottom widths are equal, the waveform is called a Square Wave, and possesses the "hollow" qualities of the reed family (i.e., the clarinet). As the pulse width proportionately decreases, a strong shift in tone color occurs; the sound becomes "nasal" in quality. This waveform is called a Pulse Wave. Pulse Width is varied on the MS-20 using the PW control (see below).

⌇

(White Noise): An unpitched sound consisting of equal amounts of all frequencies. Used for wind, surf, gunshot, percussion instrument and other such effects. The use of filters will emphasize certain frequencies over others, creating many different sound effects.

⊓

(Square Wave): A variation of the Rectangle Wave with equal top and bottom widths. A "hollow" sounding waveform with only odd numbered harmonics present. Used to simulate reed instruments and other closed pipe sounds.

⊓

(Pulse Wave): This Rectangle Waveform has a relatively narrow top width, and is characterized by a "nasal" tone quality, with strong presence of upper harmonics. Used to simulate double reed instruments (eg, the oboe) and certain plucked string sounds (eg, harpsichord and clavinet).

(RING)Ring Modulator: This setting combines the sounds of both VCO's in such a way as to create sums and differences of all harmonics present. The result is a clangorous, "metallic" sound which is useful for gong, chime and other such effects. The two Scale controls as well as the Pitch and PW controls all affect the resulting sound, and should be used judiciously to create the desired effect.

③ **Pitch:**

This control varies VCO-2's pitch over a range of ± one octave. You can either match VCO-2's pitch to VCO-1, or set it at any relative interval (eg, third, fifth, etc.). Once set, pitch levels remain extremely stable throughout the playing range, thanks to Korg technology.

④ **PW:**

This control varies the pulse width (PW) of VCO-1's Rectangle Wave. At "0", the waveform is symmetrical (i.e., Square Wave). Rotating the control clockwise proportionately decreases the pulse width. Near the full clockwise position, the pulse width becomes so narrow as to virtually disappear, and no sound will be heard.

⑤ **Portamento:**

Varies the rate of "glide" . . . the time it takes the MS-20 to go from note to note. The ability to effect smooth transitions between notes is unique to the monophonic synthesizer, and adds to the creative effects available.

⑥ **Master Tune:**

This control varies the pitch of both VCO's over a range of ± 2 semitones, so that you can match the synthesizer's pitch with that of other instruments.

Frequency Modulation controls:

These controls allow other parts of the synthesizer to affect the VCO's pitch, for such effects as vibrato, trills, pitch bends, "sweeps", etc.

⑦ **MG/T. EXT.**

Varies the intensity of Vibrato from the Modulation Generator (MG) Triangle Wave output, or whatever signal is patched into the TOTAL jack.

⑧ **EG1/EXT:**

With no patch in the patch panel's FREQ jack, this control varies the effect of Envelope Generator 1 on the VCO's. Advance the control and play a note on the keyboard. Note that the pitch of the note rises and falls corresponding to the Envelope curve (see Envelope Generator 1). With any external controller patched in (eg, Control Wheel, Reverse Envelope, etc.), the control now varies the intensity of this effect.

⑨ **VCO Mixer:**

Independent output level controls for VCO-1 and VCO-2 allow the user to freely adjust volume balance of the two oscillators, or eliminate both VCO's when processing external sound sources.

Voltage Controlled High-Pass Filter (VCHPF)

This removes portions of the harmonic elements present in the waveform chosen with the VCO section. The cut-off frequency is variable from the low range on up. Use the Cut-Off Frequency knob or an external control voltage to determine the cut-off frequency.

⑩ **Cut-off Frequency:** The scale on this knob goes from 0 ~ 10 but in the "0" position, the filter is completely open and the basic tone color of the waveform is left unchanged. As you turn up the knob, the tone color becomes brighter. Play a note on the keyboard, turn the knob, and note the effect.

⑪ **Peak:** This knob determines the amount of emphasis applied to the area right before the low range cut-off frequency chosen with the knob above. When turned up to around its maximum position, the filter itself begins to oscillate, becoming in effect another sound source. This self-oscillation capability is another big feature found in the MS-20.

Voltage Controlled Low-Pass Filter (VCLPF)

This removes upper harmonic elements of the waveforms chosen with the VCO section. The cut-off frequency is variable from the high range down and is adjusted by means of the Cut-Off Frequency knob or an external control voltage.

⑫ **Cut-Off Frequency:** The scale on the knob goes from 0 ~ 10 but in the "10" position, the filter is completely open and has no effect on tone color. As you turn the knob counterclockwise the sound will gradually become more rounded. At the lowest setting it becomes barely recognizable as a sound. Turn the knob while playing a key and note the effect.

⑬ **Peak:** This emphasizes the point right before the cut-off frequency. Near its highest position, the filter itself begins to oscillate. This self-oscillation effect may be used as a separate sound source.

Cut-off Frequency Modulation Controls:

These controls allow other parts of the synthesizer to vary each filter's cut-off frequency, in a manner similar to VCO frequency modulation.

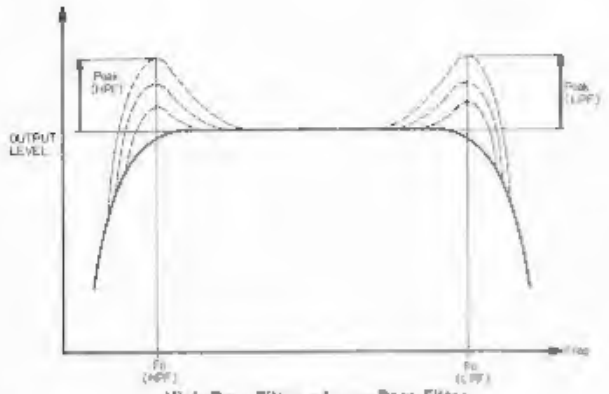
⑭ **MG/T. EXT:**

The Modulation Generator's Triangle Wave output modulates the filter frequency, for filter vibrato, automatic "wa-wa", etc.

⑮ **EG-2/EXT:**

This control varies the modulation intensity from Envelope Generator 2 (when no patch is in the respective filter CUT OFF FREQ. jack). This highly useful effect is called "filter contouring", and allows you to obtain changes in tonal quality over time. Learn to use this function, and to experiment with different settings of Envelope Generator 2 controls.

When an external device (e.g., Control Wheel, Pedal, Reverse Envelope, etc.) is patched into the appropriate filter CUT OFF FREQ jack on the patch panel, this control varies the intensity of the external modulation effect.



High-Pass Filter – Low – Pass Filter

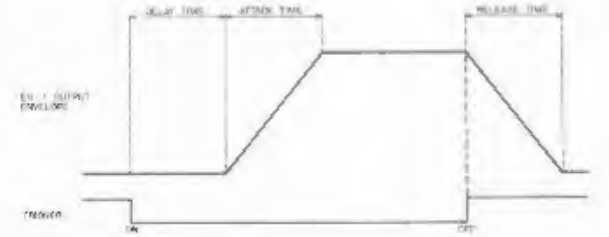
⑯ **Voltage Controlled Amplifier (VCA):**
This device varies the volume of sound passing through it in accordance with the sum of control voltages from Envelope Generator 2 (EG 2) and from any external controller patched into the patch panel VCA INITIAL GAIN jack.

Envelope Generator 1 (EG-1):
A special purpose Envelope Generator which is internally patched to the MS-20's VCO's and MVCA's (Modulation VCA) control inputs for pitch bends and delayed vibrato effects respectively. In addition, both normal and reverse envelope outputs are available at the patch panel for greater flexibility.

⑰ **Delay Time:** Determines the amount of time between the arrival of the trigger signal and the beginning of the attack cycle.

⑱ **Attack Time:** Adjusts the time it takes for the Envelope voltage to go from zero to its peak level following the end of the delay time.

⑲ **Release Time:** Determines the amount of time it takes for the voltage to drop to zero again following the termination of the trigger signal.



Envelope Generator 2 (EG-2):
This device generates a rising and falling voltage which when applied to the VCA and VCF produces corresponding changes in volume and tone color respectively. The MS-20 features a unique 5 part Envelope Generator for added flexibility. When "triggered" (usually by depressing a note on the keyboard), the EG voltage rises to a peak at a rate set by the Attack Time control, then falls at the Decay Time control rate to a level set by the Sustain Level control, and eventually falls back to zero following termination of the trigger signal and the end of the Hold Time at the Release Time control rate.

⑳ **Hold Time:** Extends the trigger signal by a variable amount of time. In effect, it "remembers" the trigger for a specified time period.

㉑ **Attack Time:** Sets the time the voltage takes to rise to a peak.

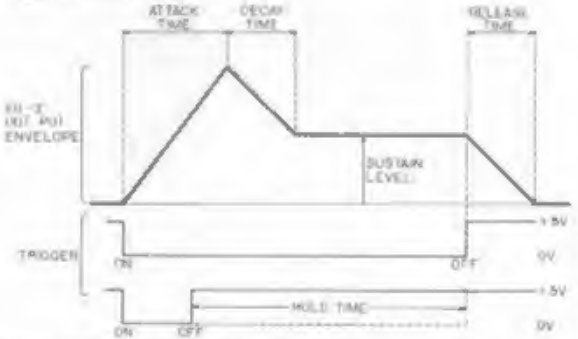
㉒ **Decay Time:** Sets the time the voltage takes to fall from the peak to the Sustain Level.

㉓ **Sustain Level:** Sets the voltage level which will be sustained for the duration of the trigger signal (plus time set by Hold control)

㉔ **Release Time:** Sets the time the voltage takes to fall to zero following termination of the trigger signal.

The EG-2 output is internally patched to the VCA so that changes in volume over time will occur to sounds according to the EG-2 control settings.

In addition, another EG-2 output is sent to the Filter Modulation controls (EG-2/EXT) so as to modulate the VCF's cut-off frequency. In this mode, the filter's "steady state" is the Sustain Level. The filter's cut-off frequency will start below this level initially, will rise above the Sustain level during the Attack cycle, will fall to the Sustain level, and then will fall below to the initial level again following trigger release.



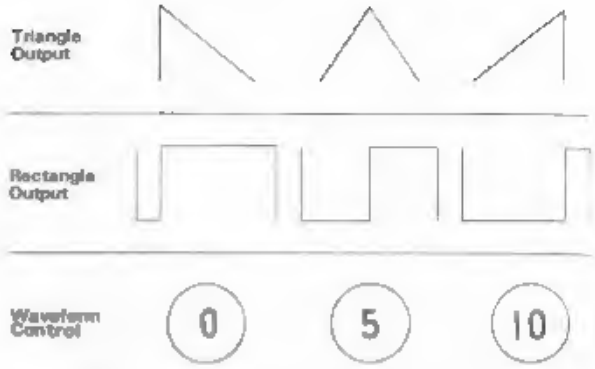
㉕ **Modulation Generator (MG)**
This device generates a variable speed low frequency modulation signal, and is also known as a Low Frequency Oscillator (LFO). Its main purpose is to provide vibrato, trills, repetitive attack, and other cyclical (i.e.,repeating) types of modulations.

The MS-20 MG features two different simultaneous waveforms – triangle and rectangle – both of whose shapes are continuously variable by means of the Waveform control (see diagram).

The MG frequency is selected by the Frequency control, and is displayed via a flashing red LED for easy visual confirmation.

Both waveforms are available via patch panel connection. In addition, the MG's Triangle Wave is internally patched to the VCO's and VCF's via their respective MG Modulation Intensity controls. This modulating signal is patched through the T. EXT jack on the patch panel.

A different modulation signal (e.g. Sample & Hold, "Delayed" Vibrato, Wheel-controlled Vibrato, etc.) may be substituted at any time and routed to all three MG intensity controls via this input jack.



Manual Controllers
Consists of two Controllers located to the left of the keyboard for easy manipulation while playing.

㉖ **Programmable Control Wheel:**
When connected to various control inputs, this highly useful device can give such effects as pitch bends, modulation depth control, filter "sweeping", sample and hold "arpeggios", and many more.

㉗ **Momentary Switch:**
This switch is useful for triggering either or both MS-20 envelope generators, or for triggering external devices,i.e.,another synthesizer or sequencer.

㉘ **Patch Panel:**
In addition to the internal patching system discussed above, the MS-20 Synthesizer features a versatile patch panel, which gives you greatly expanded creative possibilities. The following is a listing of the patch connections available.

㉙ **VCO 1+2 CV IN:** This jack allows an external controller, such as another Synthesizer,to vary the pitch levels of VCO-1 and VCO-2, instead of the MS-20's keyboard.

㉚ **VCO 2 CV IN:** Same as above, but affects VCO-2 only.

㉛ **TRIG IN:** Allows the use of external trigger sources (e.g., the MG Rectangle output, footswitch, or another synthesizer or sequencer) to trigger the MS-20 envelope generators.

㉜ **EG-1 TRIG IN:** Same as ㉛ above, but triggers Envelope Generator 1 only.

㉝ **KBD CV OUT:** Allows the MS-20 Keyboard to control the pitch of another synthesizer.

㉞ **KBD TRIG OUT:**
Whenever you play a key on the keyboard a trigger signal is generated. Ordinarily, this trigger signal output is used along with the KBD CV OUT to operate another synthesizer.

㉟ **EXT SIGNAL IN:** This jack allows such external sound sources as an electric guitar to be processed through the MS-20's VCF and VCA section. The external sound can be used alone, or combined with the VCO's by using the VCO Mixer controls. In addition, when using the ESP module, the original instrument sound can be mixed in with the synthesized sounds by using this jack.

㊳ **TOTAL EXT:** This is the input to the MG modulation controls for the VCO's and VCF's. It is internally patched to the MG Triangle wave of A different signal may be patched to this jack and used for modulation purposes.

㊴ **INITIAL GAIN (VCA):** The VCA is internally patched to the EG-2 output so that changes in volume over time can be programmed. This jack allows an external controller to vary the VCA along with the EG-2. When the sum of both controllers reaches 5 volts, no further changes in volume will occur.

㊵ **Modulation Voltage Controlled Amplifier (MVCA)**
This device is a programmable VCA normally used to vary the modulation intensity (i.e., for delayed vibrato and modulation wheel functions). Other functions can easily be programmed via the patch panel.
To set up delayed vibrato, patch the MG Triangle wave output into the MVCA input; the MVCA output is then connected to the TOTAL input jack. The MVCA control input is internally patched to the EG1 output. By use of EG1's Delay and Attack controls, delayed modulation (vibrato) functions are easily set up. Another variation would be to patch the Control Wheel output into the MVCA control input, for "Modulation Wheel" effects. Many other variations can be created with a bit of imagination and experimentation.

㊶ **Noise Generators (PINK, WHITE):** These outputs are a source of both pink and white noise, which may be used as sound sources (patched into the EXT SIGNAL IN jack) or as modulating signals. White noise is also available as one of the VCO waveforms. Pink noise is a "darker" sounding white noise, with reduced high frequency components.

㊷ **Sample and Hold (S/H):**
A device which generates "stepped" functions from variable inputs. Useful for creating "random" note effects, arpeggios, etc. Whenever "triggered" by some other device, the S/H "samples" a varying signal source (e.g., waveforms, noise, etc.) patched into its input, and "holds" its instantaneous value until a new trigger is received and a new sample taken. The triggering can be at regular intervals (e.g., from the MG Rectangle Wave) or from some other source.
The diagram below illustrates the effect of sampling Pink Noise using the MG rectangle waveform as a triggering source. (Note: when using the MG Rectangle waveform, turn the Waveform control to the extreme clockwise position for best results.) Other possible inputs for sampling are the Wheel (make yor own arpeggios), Envelope Generators (run up or down the scale at a trigger signal), or an external LFO.

㊸ **PHONES (Headphone OUT)**
Use this jack for headphones.

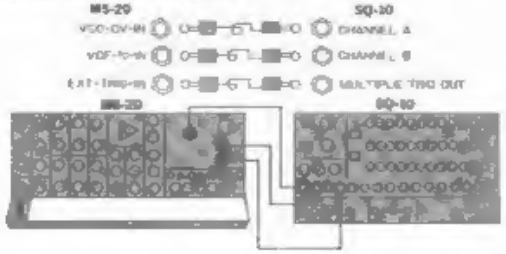
㊹ **External Signal Processor (ESP):**
This powerful module allows external instruments to actually "play" the MS-20 synthesizer, with the same power and flexibility as achieved by playing the keyboard!
Since everything in a synthesizer is voltage controlled, it is normally not possible to control a synthesizer directly with an external instrument, which generates audio signals. However, the MS-20's ESP module permits external sound sources to vary the synthesizer's pitch, volume, tone color and attack and decay by means of built-in Pitch and Envelope Followers, which produce control voltages conforming with the input signal's pitch and volume respectively. A trigger signal can also be produced to trigger the MS-20's Envelope Generators, for programmed attack/decay cycles.
The ESP Module consists of high gain preamplifier, variable bandpass filter, Envelope Follower/Trigger Detector, and Pitch to Voltage converter. The various outputs are available at the patch panel for connections to other parts of the synthesizer.

6) About Patching

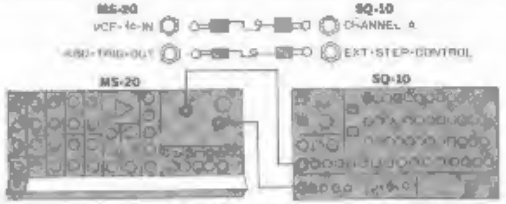
Setting up a patch is one way of using the MS-20 more effectively for synthesizing sounds. Patching involves using such outputs as the control wheel in a creative way to control various synthesizer functions thus increasing the variety of sounds and effects possible. When setting up a patch, follow these steps to be sure you get the effect you want:
(1) Where (VCA, VCF, VCO, etc.) do you want to create the effect and what kind of effect do you want?
(2) What kind of control signal will you need for that effect?
(3) Which section of the synthesizer will generate that kind of control signal?
If you don't put your thoughts into this order before you start connecting patch cords from one jack to another, you will not be able to synthesize the sound you want. Even if you just use the internal patch without external patch cords, these same rules apply. When you want a certain sound, break it down into its elements of pitch (frequency), tone color or timbre (harmonic elements), and volume (envelope or amplitude change over time).
Then put these elements together by using the various sections of the synthesizer.
Remember that the keyboard generates both a control voltage and a trigger signal every time you play a key. In other words it acts both as a control knob and a switch. Make full use of this and other less obvious possibilities for creating sounds. The more techniques you know, the more freely you'll be able to play the music you want.

7) Expanding Your System

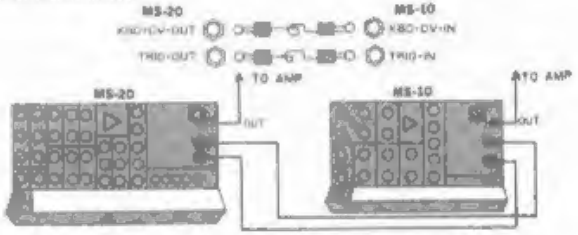
* Here are two examples using the SQ-10 Korg Analog Sequencer.
(1) One simple idea is to set the SQ-10 to determine the pitch and tone color produced by the MS-20 at each step. Then if you use the internal clock of the SQ-10 to run through the steps, you will have automatic control of the MS-20.



(2) For a live performance, another effective way of using the SQ-10 is to set up a patch so that the SQ-10 advances one step and changes the tone color every time you play a key on the MS-20.



* In this example the MS-10 is used with the MS-20 to increase the depth and richness of the sound.
Connect patch cords from the MS-20 KBD CV OUT and TRIG OUT jacks to the MS-10 VCO CV IN and TRIG IN jacks. With this arrangement, both synthesizers operate together when you play the keyboard of the MS-20. But if you try to play the MS-10 keyboard, nothing will happen because it has been disconnected by the patch cords in the VCO CV IN and TRIG IN jacks. So decide which keyboard you want to use before you set up the patch.
Try using separate amplifiers (or left and right stereo channels) for each synthesizer.



Setting both synthesizers to produce the same sound and then changing the pitch slightly on one of them will give you a phase effect or jet effect. This can be effectively used both on stage and for multi-track recording.

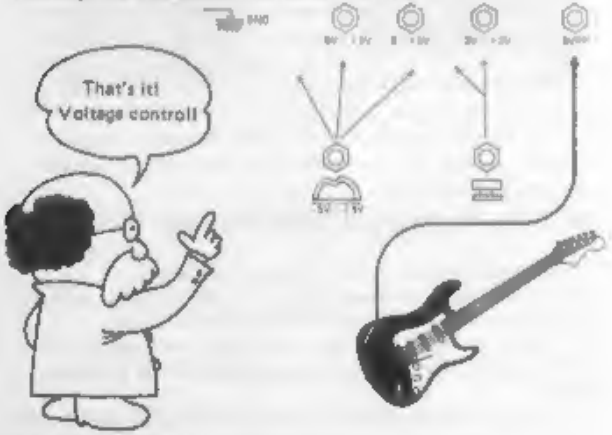
8) Using the External Signal Processor (E.S.P)

To use the ESP module, follow the steps listed below:
(1) Connect the external signal source (eg, electric guitar, microphone, electric piano, etc.) to the ESP's SIGNAL IN jack.
(2) Adjust the Signal Level so that the Peak Level indicator only flickers slightly when the external signal input reaches maximum volume.
(3) Turn the Threshold Level control clockwise while watching the TRIG OUT light, until it lights when playing at medium to high voltage levels.
(4) Connect F ∝ V CV OUT to VCO 1+2 CV IN (or VCO 2 CV IN); connect TRIG OUT (ESP) to the TRIGGER IN jack, and the ENV OUT jack to the VCA's INITIAL GAIN jack.
(5) To adjust the Bandpass Filtering section for proper operation first set LOW CUT FREQ to "10" and HIGH CUT FREQ to "0". Play the highest note the ESP is to pick up, and slowly turn the HIGH CUT control clockwise until the desired pitch is picked up.

Next play the lowest note and turn the LOW CUT control counter-clockwise until it is registered on the MS-20. This completes the Bandpass Filter adjustments.
(6) Adjust the CV ADJUST control until the MS-20 pitch matches that of the input instrument.
(7) If desired, the original sound of the instrument may be mixed with the synthesized sounds by patching the ESP's PRE-AMP out to the EXTERNAL SIGNAL IN jack.
Once the above steps have been completed, the MS-20 may be programmed for different sounds in the same manner as when the keybord is utilized.

9) Caution

(1) On the MS-20 there are removable covers at eight places. If you remove these covers you will see semi-fixed volume controls. But never touch these controls. They have been adjusted at the factory to give optimum results. If you turn these knobs performance will deteriorate and the synthesizer may be damaged. (For example, since the VCO is the heart of the synthesizer, if its balance is upset, everything else will go too.)
(2) Pay attention to the voltage indications (0 ~ +5, −5V ~ +5V, 5Vpp, GND, etc.) on the patching panel and their relationship with the block diagram and signal flow chart. Note that if you connect a −5 ~ +5V control signal to a 0 ~ +5V input jack, nothing will happen during the −5 ~ 0V portion of the control signal. It will only operate from 0V to +5V. So always consider both the characteristics of the output and the input and whether the signal is analogue or digital when you set up a patch.



10) Specifications

< CONTROL SECTION >

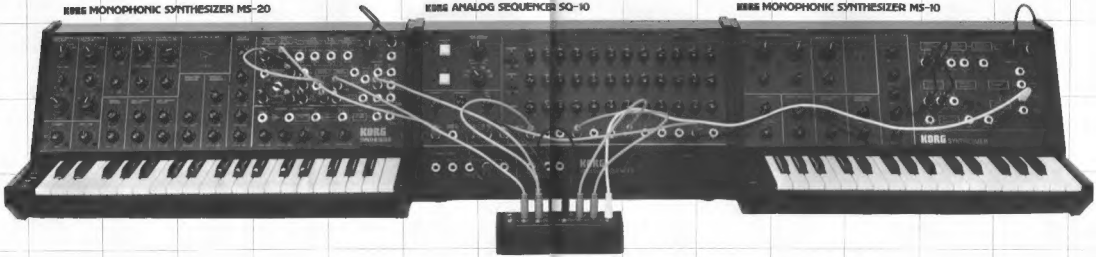
1. Keyboard	* C~C 37 keys/(3 octaves)
2. Voltage controlled oscillator 1 (VCO 1)	* Scale [32', 16', 8', 4'] /(6 octaves + 6 octaves (FM))
	* Waveform [/\ /\ PW (⊓-⊔), white noise] /(4 modes)
	* Pulse width adjust
3. Voltage controlled oscillator 2(VCO 2)	* Scale [16', 8', 4', 2'] /(6 octaves + 6 octaves(FM))
	* Waveform (/\⊓⊔ , Ring modulator] /(4 modes)
	* Pitch/(±1 octave)
4. VCO master control	* Master tune/(±½ octaves)
	* Portamento
	* Frequency modulation intensity by MG/T. EXT
	* Frequency modulation intensity by EG1/EXT
5. VCO mixer	* VCO-1 level
	* VCO-2 level
6. Voltage controlled high pass filter	* Cutoff frequency
	* Peak [flat ~ self OSC]
	* Cutoff frequency modulation intensity by MG/T. EXT
	* Cutoff frequency modulation intensity by EG2/EXT
7. Voltage controlled low pass filter	* Cutoff frequency
	* Peak (flat ~ self OSC)
	* Cutoff frequency modulation intensity by MG/T. EXT
	* Cutoff frequency modulation intensity by EG2/EXT
8. Envelope generator 1	* Delay time
	* Attack time
	* Release time
9. Envelope generator 2	* Hold time
	* Attack time
	* Decay time
	* Sustain level
	* Release time
10. Modulation generator	* Waveform (/\ ~ /| ⊓ ⊔ ⊔)
	* Frequency
11. Manual controller	* Control wheel
	* Momentary switch
12. P. switch & volume	* Volume
13. Indicator	* Led [trigger, MG rate]

<EXTERNAL SIGNAL PROCESSOR >

1. Control section	* Input signal level
	* Low cut frequency
	* High cut frequency
	* CV adjust
	* Threshold level
2. Input & output	* Signal in (auto pad system)
	* Amplifier out/0~+8V
	* Band pass filtered out
	* CV out (F/V) / 0~+8V
	* ENV out/0~+5V
	* Trig out/ ⏚ GND
3. Indicator (LED)	* Peak indicator
	* Trigger indicator

< PATCH PANEL SECTION >

1. Keyboard	* Keyboard control voltage output (exponential) /0~+8V
	* Keyboard trigger output/ ⏚ GND
2. VCO	* VCO 1 + VCO 2 control voltage input (linear response) /0~+8V
	* VCO 2 control voltage input (linear response) /0~+8V
	* VCO 1 + VCO 2 external frequency control input (OCT/V) /−3V~+3V
3. VCF	* External signal input/3Vpp max
	* External HP filter cutoff frequency control input (20CT/V) /−5V~5V
	* External LP filter cutoff frequency control input (20CT/V) /−5V~+5V
4. VCO + VCF	* Total external modulation input (T. EXT) /−5V~+5V
5. VCA	* External initial gain control input/ 0~5V
6. EG	* EG 1 envelope signal normal output/−5V → 0V
	* EG 1 envelope signal reverse ou output/+5V → 0V
	* EG1 + EG2 trigger input/ ⏚ GND
	* EG1 + trigger input/ ⏚ GND
	* EG2 envelope signal reverse output/ ⏚ 0V
7. MG	* Triangle output (/\~/\~/|) /5Vpp
	* Rectangle output (⊓~⊓~⊔) / 0⟷+5V
8. Noise generator	* Pink noise output/5Vpp
	* White noise output/5Vpp
9. Sample and hold	* Clock trigger input/ ⏚ GND
	* Sample signal input/5Vpp
	* S/H output/5Vpp
10. Modulation VCA	* Control voltage input/0~+5V
	* Signal input/−5V~+5V
	* Signal output/−5V~+5V
11. Manual controller	* Control wheel output/−5V~0V~+5V
	* Momentary switch/ ⏚ GND
12. Signal out	* Signal output/2Vpp (output impedance 3.5kΩ)
13. Headphones	* Headphones out/(8Ω) 120m 120mwatts
●Power consumption	* 10 watts
●Dimensions	* 569(W)*x 309(D) x 249(H) mm
●Weight	* 7.7 kg
●Accessories	* Patch cord, connecting cord/ 35 cm x 2, 3 m x 1
●Optional equipment	* Stand, case


KORG MONOPHONIC SYNTHESIZER MS-20
KORG ANALOG SEQUENCER SQ-10
KORG MONOPHONIC SYNTHESIZER MS-10
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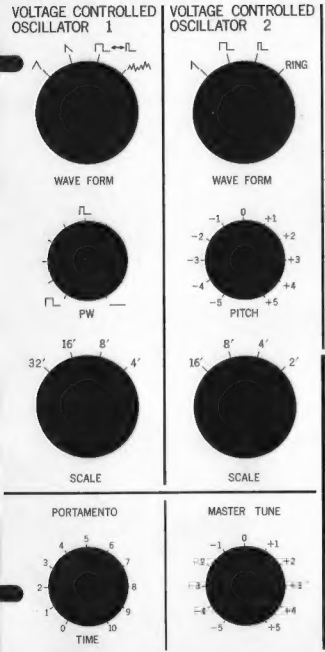
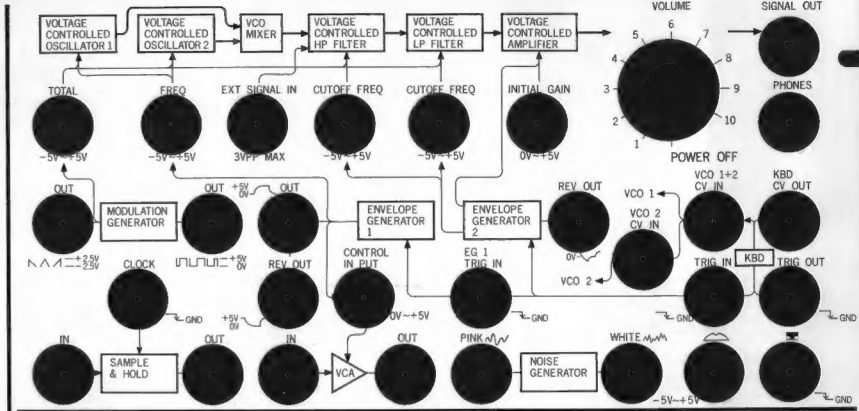

VOLTAGE CONTROLLED OSCILLATOR 1
WAVE FORM
PW
SCALE
VOLTAGE CONTROLLED OSCILLATOR 2
RING
WAVE FORM
PITCH
SCALE
PORTAMENTO
TIME
MASTER TUNE
VCO MIXER
VCO 1 LEVEL
VCO 2 LEVEL
VOLTAGE CONTROLLED HIGHPASS FILTER
CUTOFF FREQUENCY
PEAK
VOLTAGE CONTROLLED LOWPASS FILTER
CUTOFF FREQUENCY
PEAK
FREQUENCY MODULATION
MG/T.EXT
EG1/EXT
CUTOFF FREQUENCY MODULATION
MG/T.EXT
EG2/EXT
CUTOFF FREQUENCY MODULATION
MG/T.EXT
EG2/EXT
VOLTAGE CONTROLLED AMPLIFIER
EG 2 & EXT
MODULATION GENERATOR
WAVE FORM
FREQUENCY
ENVELOPE GENERATOR 1
DELAY TIME
ATTACK TIME
RELEASE TIME
ENVELOPE GENERATOR 2
HOLD TIME
ATTACK TIME
DECAY TIME
SUSTAIN LEVEL
RELEASE TIME


VOLTAGE CONTROLLED OSCILLATOR 1
VOLTAGE CONTROLLED OSCILLATOR 2
VCO MIXER
VOLTAGE CONTROLLED HP FILTER
VOLTAGE CONTROLLED LP FILTER
VOLTAGE CONTROLLED AMPLIFIER
VOLUME
SIGNAL OUT
PHONES
POWER OFF
TOTAL
FREQ
EXT SIGNAL IN
CUTOFF FREQ
CUTOFF FREQ
INITIAL GAIN
MODULATION GENERATOR
ENVELOPE GENERATOR 1
ENVELOPE GENERATOR 2
REV OUT
VCO 1
VCO 2
VCO 1+2 CV IN
KBD CV OUT
CLOCK
CONTROL IN PUT
EG 1 TRIG IN
TRIG IN
KBD
TRIG OUT
SAMPLE & HOLD
VCA
PINK
NOISE GENERATOR
WHITE
EXTERNAL SIGNAL PROCESSOR
SIGNAL IN
AMP
BAND PASS FILTER
F-V CONVERTER
F∝V CV OUT
ENVELOPE FOLLOWER
PEAK
ENV OUT
TRIG OUT
SIGNAL LEVEL
LOW CUT FREQ
HIGH CUT FREQ
CV ADJUST
THRESHOLD LEVEL
KORG
SYNTHESIZER